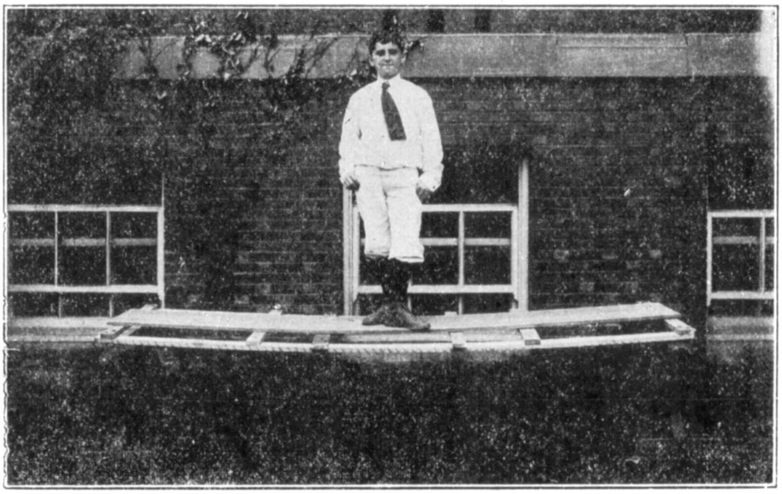


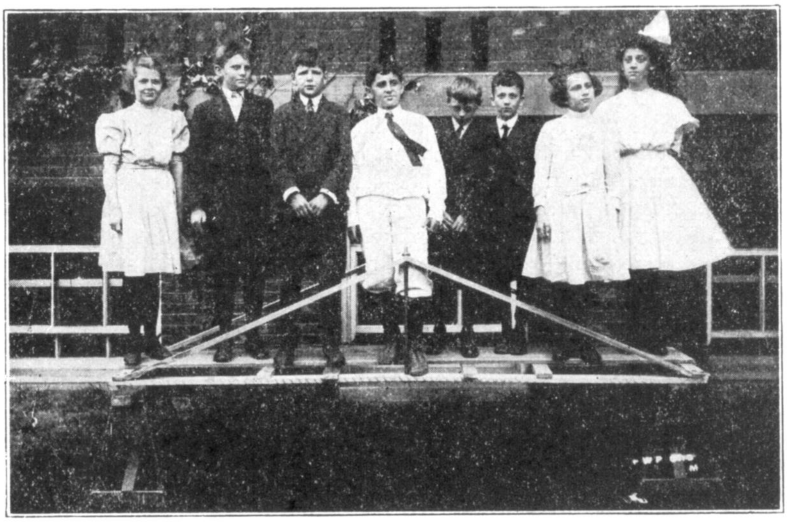
Bridge without Trusses

A STUDY OF BRIDGES

LEONARD W. WAHLSTROM

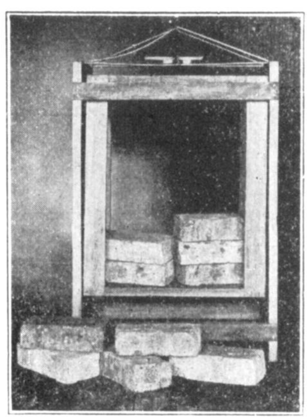
The exercise on bridges is an outgrowth of the shopwork. The importance of bridges in our community life, the various types of bridges in different localities (connecting vitally with geography work), the romance of their building, the deeds of bravery, daring, and skill of the bridge worker, and a study of the strains and stresses of the various "members" of a bridge, are topics of live interest to the fifth- and sixth-grade boy. This study in the shop results in an intelligent appreciation of a bridge as a wonderful human achievement. In place of a meaningless mass of iron and steel, a bridge becomes almost a living thing. By means of experiments on test bridges, the effect of "teamwork" is emphasized—how different members of the bridge are working together to help to support the load it is designed to carry, some "pushing" and some "pulling." "Tension," "compression" and similar terms used by the bridge engineer become a part of the boy's vocabulary. This interest bears fruit in a desire to share his knowledge with the rest of the School in a morning exercise. Lantern slides of some of the noted bridges are thrown on the screen, and the mechanical principles explained. Experiments are performed, and the different strains and stresses in a bridge are pointed out. The following verbatim report is the result of the work of one class.

Emily. The fifth grade have been studying about bridges and the different things an engineer has to think about when drawing plans for a large bridge and the materials to build with. When the heavy weight is going over the bridge some pieces of the bridge are pushing, and some are pulling to help to carry the load.



Bridge Showing Effect of Truss

The engineer has to be a careful man, and he has to be a mathematician. Before he builds a bridge, he has to work it all out on paper. Then sometimes, he makes small models like these (*showing models*) to experiment with. When he is building the bridge, every single thing has to be right; he can not guess at a single thing; there are too many human lives in danger. And when a beam is put in place, an inspector has to climb over it, and with a hammer he taps the heads of the rivets, and if they do not sound just right, he draws a ring around them, and a workman comes and cuts it out and puts in a new one, and makes it tight. There is a bridge in Quebec over the St. Lawrence river, and when they were building it, and had quite a good part of it done, and the workmen were on it, it collapsed. They found that one beam on the under side had been too weak, and it went down, and several of the workmen were killed. This is going to happen every time that an engineer is not accurate in his plans.

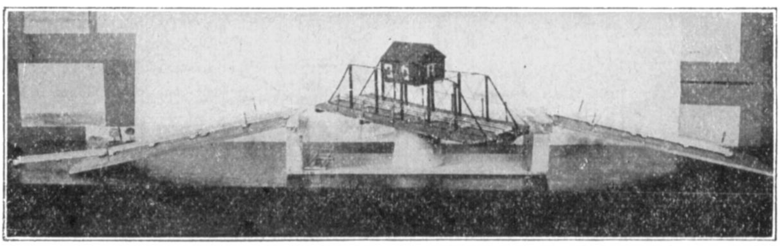


Test Box Used in Experiments

Arnold. We performed several experiments to find out what the different parts of a bridge will do, and we found that some parts of the bridge push and some parts pull. This is a model of a simple bridge. I suppose most of you have crossed a stream where there was a board across, and when you got to the middle, it would bend like this. We had a testing-box made, so that we could put the weight on top of this bridge. And then we put the weight down here, and it acts just the same as if we put it on top of the bridge.

Now I am putting trusses on this simple bridge. The bridge without

the trusses held 18 lb. 13 oz. We tested it until it broke. This bridge with the trusses does not bend so much, because the weight pulling down on this beam, pulls on these wires. There are different strains on different parts of the bridge. There is the pulling of tension strain, the pushing or compression strain, and the transverse or bending strain. In this wire there is a tension strain, and in these trusses, there is a compression strain. This bridge broke at 125 pounds, while the other broke at 18 lb. 13 oz.; so you can see how much the trusses do for a bridge. When we put about 50 lb. on the bridge, we first noticed a change. The weight pushing on here and here bent this in like this, but it could not go down because the wires were holding it. The truss broke first because it had not been cut accurately, it was a little shorter than the other. Then this part had to break, because when the trusses were gone, it was nothing but a simple bridge and would only hold 18 lb. 13 oz.



Model of Swing-Bridge Built by Boy

Russell. We are going to show you a simple bridge, only bigger. You see how easily it bends without the trusses. We will put the trusses on now.

(*Four boys put trusses on a simple bridge, about seven feet long, and eleven children got on it.*)

This summer when I was out in the country, they had simple bridges without trusses, and the men who had threshing machines, carried trusses with them, only they used chains instead of wires. The bridges were not strong enough to carry the threshing machines without the trusses.

Lawrence. This bridge seems almost like that one. We studied a good deal about it, and we found it would have altogether different strains. When in this position, this has the tension strains, and this the compression strain.

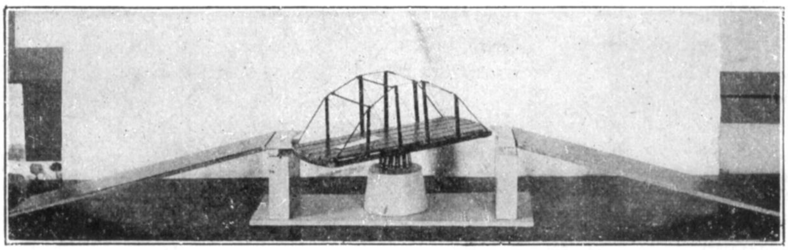
David. This kind of a beam is called an "I" beam, because it is just like the letter "I" in section. There are fibers in iron, just as there are fibers in wood, and the fibers at the top of the beam try to pull apart, and at the bottom, they push together, when it is loaded. This is a diagram of a bridge, and they put these "I" beams where there is the greatest strain. You can see some of these "I" beams on the elevated road at Wilson Avenue. It is the beam that holds the track up. Some of these "I" beams are forty feet long and a foot wide.

Paul. I made a little model of a swinging-bridge, to see where the different strains were. The weight is carried from the ends to the center pivot. This top piece has a tension strain, and this piece has a compression strain.

Lawrence. I made a model of a bridge and took it down to Mr. Wahlstrom last night. He got on it with both feet and it would hold 150 pounds.

Question from audience. How long would it take to build a big bridge?

Mr. Wahlstrom. On one of the large bridges in New York they spent four years drawing the plans, and the engineer had a force of twenty-five to fifty men. After they begin work on such a bridge, it takes anywhere from two to ten years, according to the size. Of course small bridges are built much more quickly.



Another Model Swing-Bridge Made by Boy